

REMARKS

The Office Action of November 14, 2006 has been received and carefully reviewed. It is submitted that, by this Response, all bases of rejection are traversed and overcome. Claims 1, 5-24 and 28-40 remain in the application. Reconsideration of the claims is respectfully requested.

Claims 1, 5-24 and 28-40 stand rejected under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement. The Examiner states that there is no "teaching in the specification for controllably forming in 3d as is now claimed and no support for growth in the 3d."

Applicants continue to respectfully disagree with the Examiner, and reiterate their arguments submitted previously. In addition, Applicants will supply further examples of enablement here. It is submitted that controllable growth in the third-dimension is taught throughout the specification as filed, at least in the following non-limiting examples:

- 1) paragraph [0039] states in part:

Thus, small catalyst nanoparticles (leading to narrow diameter nanowires) and short isolated segments can create quantum dots. Thus, the isolated segments are **controllably placed in all three dimensions**. (emphasis added)

- 2) paragraphs [0030] – [0031] state in part:

As shown in FIG. 3a, a catalyst array 114 [*shown in two dimensions*], comprising a plurality of catalyst nanoparticles 14, is formed on a surface 16a [*shown as a two dimensional surface*] of substrate 16,

In FIG. 3b, an array 118 of nanowires 18 [*shown in the third dimension*] is next formed, again employing the techniques described above [*for example, with regard to Fig. 2, which shows growth of nanowire 18 into the third dimension from the two dimensional substrate surface 16a*]. (explanation added)

3) paragraph [0043] states in part:

The segments 18a, 18b are **grown** by simply **controlling** the gas flow of one or the other of the foregoing gaseous compounds. (emphasis added)

4) paragraph [0045] states in part:

The nanowire growth can be terminated by removing the catalyzing nanoparticle [*particle 14 is shown at the tip of nanowire 18 in Fig. 3b*] at the tip of the wire; . . . Alternatively, the deposition conditions can be changed so that catalytic growth is no longer favored over normal growth. (explanation added)

The Examiner further stated in his "Response to Applicants' Arguments" that "[t]here is no teaching in the specification which even alludes to the control as is now set forth." In sharp contrast to the Examiner's assertion, it is clear, at least from the above quotes and the figures referred to therein (as well as the application as a whole), that there is clear support for controllably forming in 3D and growth in 3D. As such, it is submitted that the Examiner's assertion is clearly erroneous.

Further regarding the written description requirement, the courts have held that the subject matter of the later claim need not be described literally or "*in ipso verbis*" in order for the specification to satisfy the description requirement. See, e.g., *Cordis Corp. v. Medtronic AVE, Inc.*, 339 F.3d 1352 (Fed. Cir.), reh'g denied, 2003 U.S. App. LEXIS 22508 (2003); and *In re Lukach*, 442 F.2d 967, 969, 169 U.S.P.Q. 795, 796 (C.C.P.A. 1971).

Thus, it is submitted that the support for the recitation of controllably forming or growing nanowires in the third dimension may, indeed, be gleaned from the specification and drawings as originally filed and as understood in their totality.

As such, it is again submitted that the rejection under 35 U.S.C. § 112, first paragraph is erroneously based, and withdrawal of the same is respectfully requested.

Claims 1, 5-7, 10-18, 20-24 and 28-40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (U.S. Patent No. 6,831,017) in view of Gudiksen et al. (referred to herein as "Nature Paper"). The Examiner states that Li fails to teach that

the nanowires are made of two different materials. The Examiner then states that the Nature Paper teaches growing nanowires having two different materials. The Examiner concludes that it would have been obvious to the skilled artisan to modify the Li reference to have two materials in the nanowire in order to create diverse applications for the nanowire structure.

In the Office Action, the Examiner stated that since the 1.132 Declaration only referenced one embodiment of Li, the Examiner was maintaining his rejection. Applicants do not agree with the Examiner's decision to afford little or no weight to the Declaration, and still offer the 1.132 Declaration as evidence that one skilled in the art would not be led to combine the Li and Nature Paper references in the manner suggested by the Examiner.

Applicants are controllably growing two-material nanowires from a two dimensional surface into a third dimension. *Li* teaches growing single material vertical nanowires. The *Nature Paper* teaches growing two-material nanowires on a two dimensional surface (it does not appear that the nanowires are attached to the substrate surface), and then removing them for desired applications.

The Examiner has not provided a suggestion gleaned from either of the references as to why a skilled artisan would assume that methods for growing nanowires in two dimensions, apparently not attached to a substrate surface (Nature Paper) would be appropriate for incorporating into a method for growing vertical nanowires that remain on a substrate surface (Li). In fact, Applicants submit that the skilled artisan would not be so led to combine the Li and Nature Paper references in the manner suggested by the Examiner, at least for the reasons set forth below and in the previously filed 1.132 Declaration.

Applicants respectfully submit that the Nature Paper does not teach, nor suggest any reason for removal of the **native oxide** from the substrate upon which the nanowires are grown. It is submitted that vertical nanowires, such as those shown in the Li reference, cannot be grown from such a substrate having the native oxide thereon. As the Nature Paper teaches removal of the nanowires from the substrate after growth, the alignment of the nanowires during growth is not important. The random direction that one can achieve on an amorphous surface, such as a native

oxide, is adequate if one is planning to remove nanowires from the substrate after growth. Therefore, one would not be led by the Nature Paper to remove the native oxide layer to form vertical nanowires.

As such, if one applied the Nature Paper methods to the Li methods, vertical nanowires would fail to grow, thus destroying the stated purpose of the Li reference.

Applicants further reiterate their arguments regarding specifically claims 7 and 30, which arguments the Examiner failed to address in the latest Office Action. Applicants recite materials that form **crystalline nanowires in a matrix of a crystalline material**. In sharp contrast, Li teaches *amorphous matrix materials*. The Nature Paper teaches crystalline nanowires, but no matrix. Applicants respectfully submit that the three-dimensional nanocrystal array of Applicants' invention as defined in claims 7 and 30 cannot be achieved in an amorphous matrix. In one non-limiting example, in order to obtain isolated nanocrystals embedded in a **uniform** matrix, the matrix is the same material and has the same crystal structure as the segments surrounding the segment that becomes the isolated nanocrystal.

Therefore, an amorphous matrix (as taught by Li) does not satisfy the components for this structure (i.e. crystalline nanowires in a matrix of a crystalline material), and thus would not render obvious Applicants' invention as recited in claims 7 and 30.

For all the above reasons, it is submitted that Applicants' invention as defined in claims 1, 5-7, 10-18, 20-24 and 28-40 is not anticipated, taught or rendered obvious by Li and the Nature Paper, either alone or in combination, and patentably defines over the art of record.

Claims 8, 9 and 19 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Li in view of the Nature Paper. The Examiner admits that neither of the references teach a mold for applying the catalyst material. The Examiner concludes however, that in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art through routine experimentation to find the optimum, operable means to pattern and apply the catalyst of Li.

Applicants respectfully submit that the Examiner has failed to set forth a *prima facie* case of obviousness. Neither of the cited references teaches or suggests the specific method steps recited in claims 8, 9 and 19. If the Examiner wishes to maintain this rejection with regard to these claims, Applicants request that the Examiner cite a reference that teaches these specific steps within the context of the independent claims from which these claims depend.

Assuming *arguendo* that this were a proper *prima facie* obviousness rejection, Applicants respectfully submit that neither Li nor the Nature paper teach or suggest a mold for applying the catalyst material, nor the recitations of claims 8, 9 and 19. Applicants' mold as recited in these claims allows precision positioning of the catalyst particles with respect to each other. The mold allows controllability of 3-D nanowires to within several nm in the plane defined by the substrate (see paragraph [0023] in the specification as filed, "protruding features 12 of the mold 10 will have a lateral dimension within the range of about 5 to 20 nm.>").

Specifically with regard to claim 9 (set forth in part immediately below for convenience), neither reference teaches or suggests any of these steps:

- imprinting a first line of material over a layer of said catalyst material;
- etching to remove catalyst material where not protected;
- imprinting a second line of material orthogonal to said first line; and
- etching to remove catalyst material where not protected, so that said catalyst only remains where protected by both imprints.

In particular, neither reference teaches or suggests imprinting a second line of material orthogonal to the first line of material.

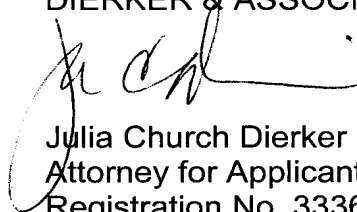
For all the reasons stated above, it is submitted that Applicants' invention as defined in claims 8, 9 and 19 is not anticipated, taught or rendered obvious by the cited references, either alone or in combination, and patentably defines over the art of record.

In summary, claims 1, 5-24 and 28-40 remain in the application. It is submitted that, through this response, Applicants' invention as set forth in these claims is in a condition suitable for allowance.

Further and favorable consideration is requested. If the Examiner believes it would expedite prosecution of the above-identified application, he is cordially invited to contact Applicants' Attorney at the below-listed telephone number.

Respectfully submitted,

DIERKER & ASSOCIATES, P.C.

A handwritten signature in black ink, appearing to read "Julia Church Dierker", is written over the printed name and title.

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